



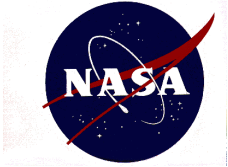
# **DEDICATED RADIOSONDE VALIDATION MEASUREMENTS**

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Observational Science Branch

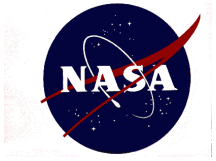
Wallops Island, Virginia 23337



# **UPPER AIR INSTRUMENTATION: RESEARCH AND PROJECTS**

**IMPROVE AND/OR REFINE UPPER AIR METEOROLOGICAL  
INSTRUMENTS AND PROCESSING METHODS FOR OBTAINING MORE  
ACCURATE OBSERVATIONS TO MEET THE NEED OF TODAY'S  
CLIMATE CHANGE RESEARCH**

**PARTICIPATE IN EARTH SCIENCES ATMOSPHERIC STUDIES**



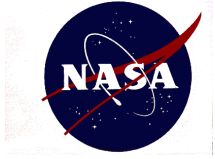
# UPPER AIR DISCIPLINES

**TEMPERATURE** (BALLOON-BORNE ATM\* RADIOSONDES)

**WATER VAPOR** (BALLOON-BORNE CHILLED MIRROR INSTRUMENT)

**OZONE** (ECC-VERTICAL PROFILES; GROUND-BASED TOTAL OZONE)

\* ACCURATE TEMPERATURE MEASUREMENT



# ATM RADIOSONDE

Uses three thermistors; each with different emissivity and absorptivity values

Simultaneously solve three equations in Heat Balance Equation

$$-HA(T) + R + S - \epsilon A T^4 + 2 r_{wi}^2 k_{wi} (dT_{wi}/dl)_{l=0} = CdT/dt$$

Nature of technique does not require knowledge of environmental radiative background

Tropospheric accuracy believed to be: 0.2°C – 0.3°C

Stratospheric accuracy believed to be: 0.3°C – 0.4°C

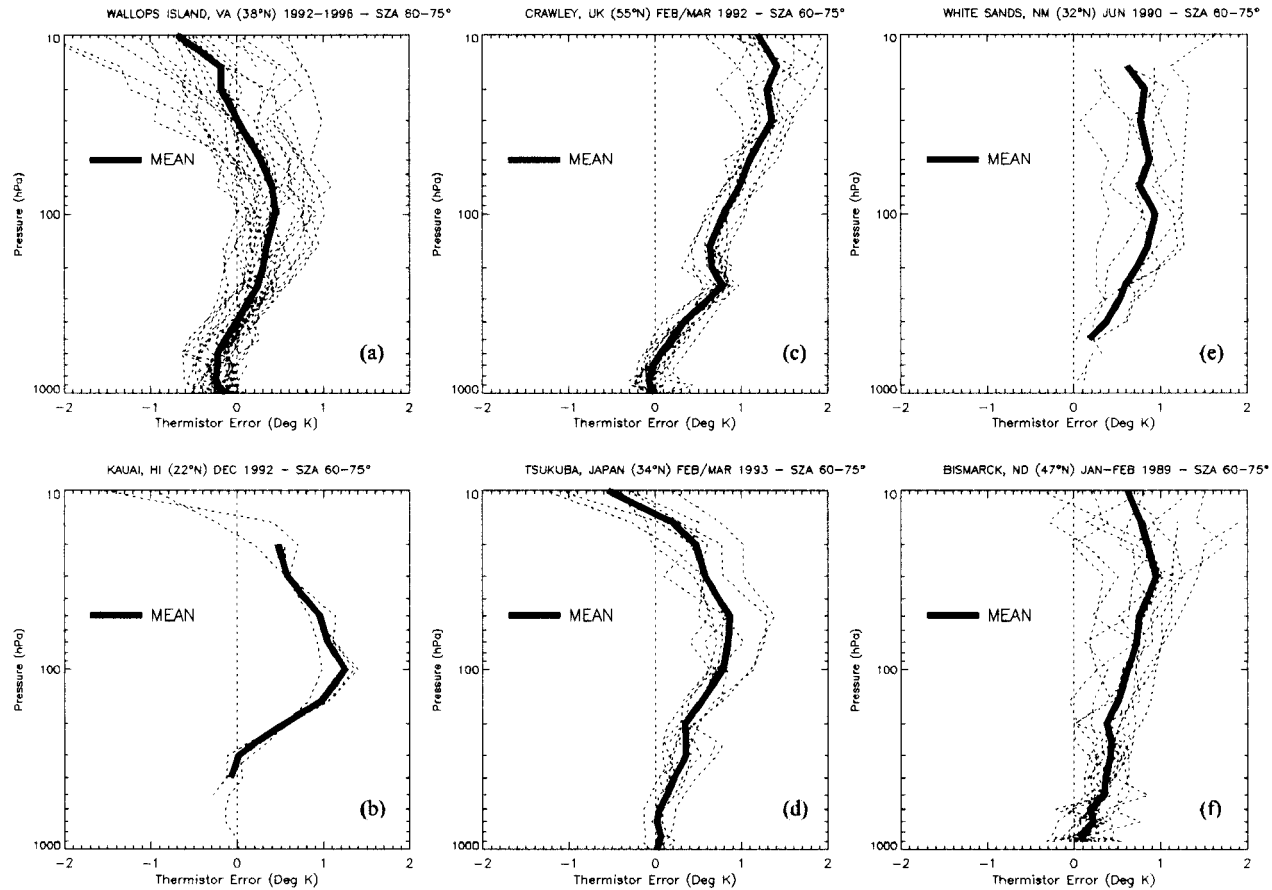
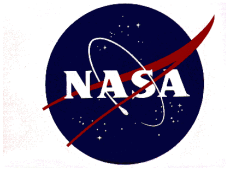
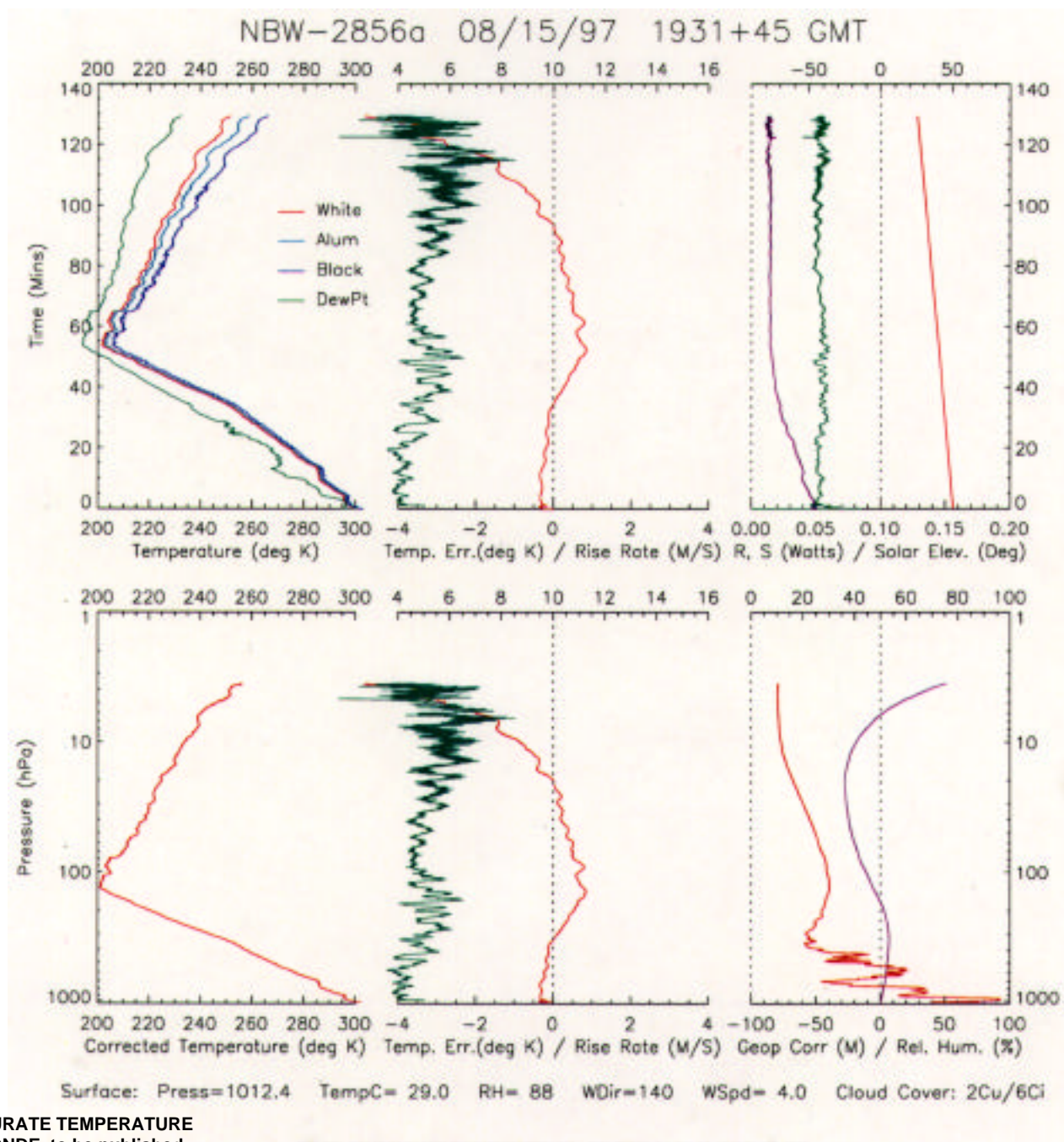
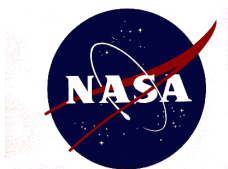
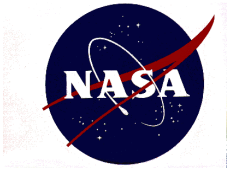


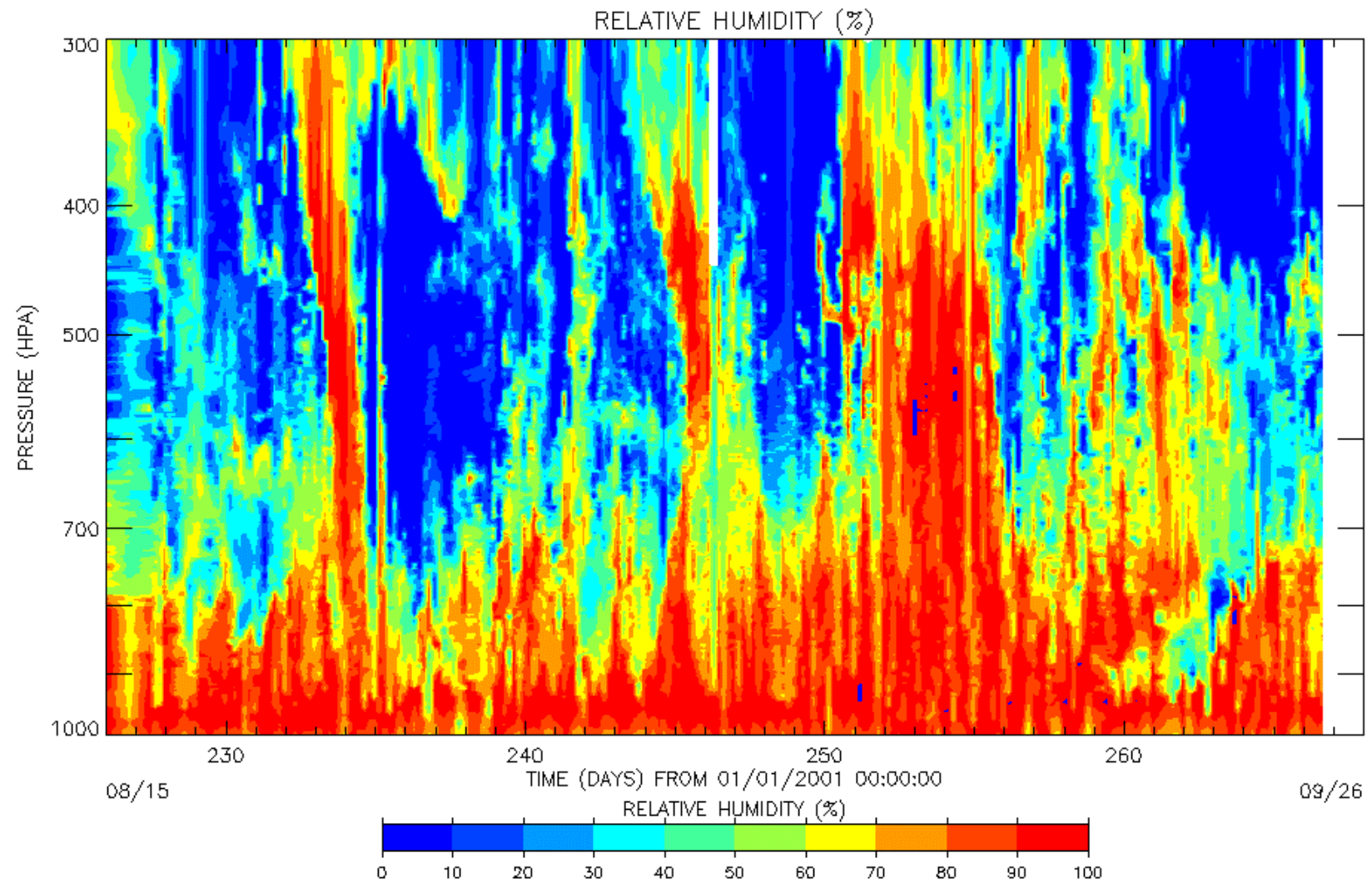
Fig.5. Examples of thermistor errors obtained from each of the six observation sites. Dotted lines represent individual observations; heavy solid line is the mean thermistor error. The period over which the observations were obtained is a few weeks except for Wallops Island where the record covers many different months over a five year period. The different shapes and magnitudes of the mean errors should be noted.



DEVELOPMENT OF AN ACCURATE TEMPERATURE  
MEASURING (ATM) RADIOSONDE, to be published



# CAMEX - 4



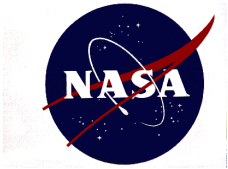
HYCRISTOR MEASUREMENTS



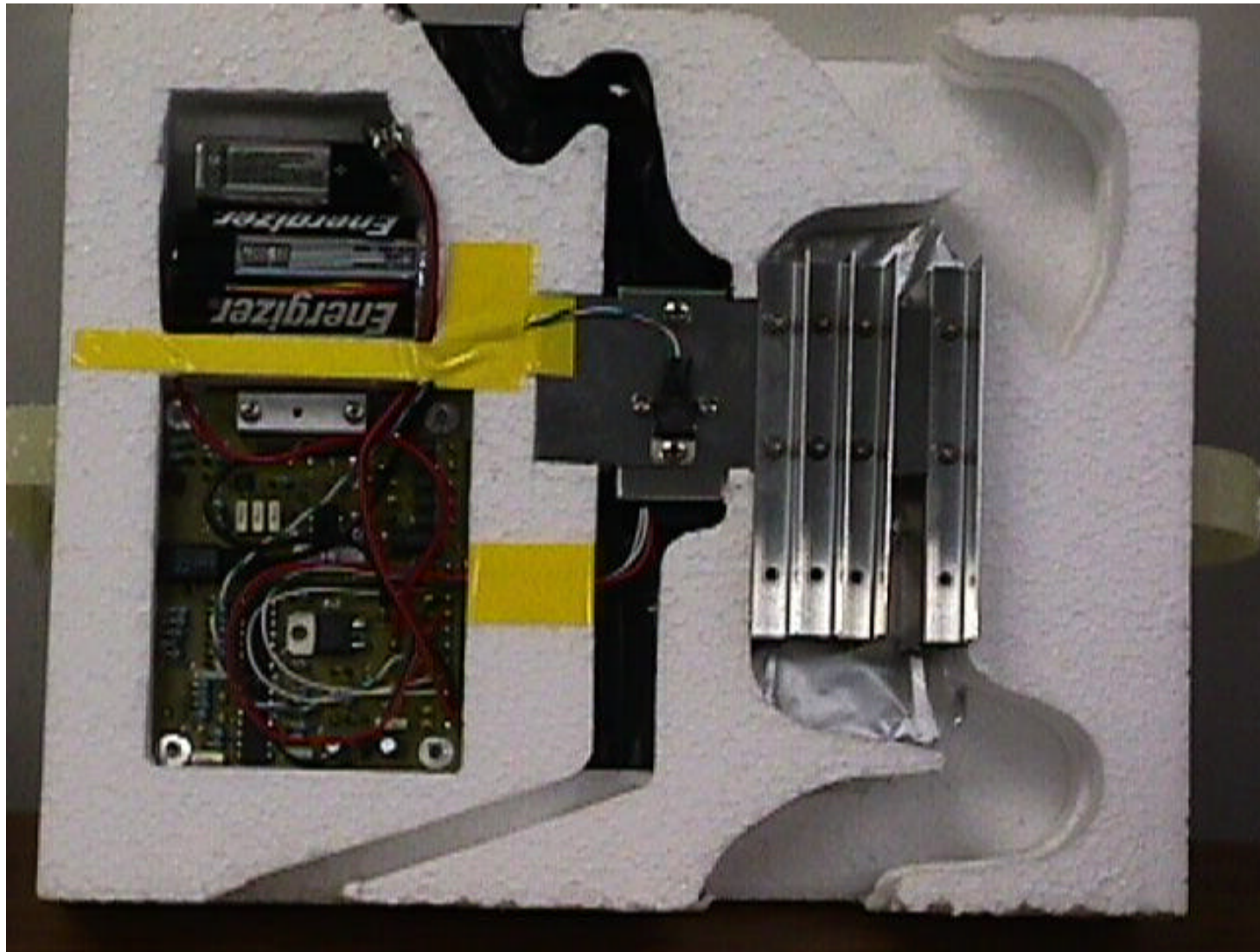
## CHILLED MIRROR DEW POINT SENSOR

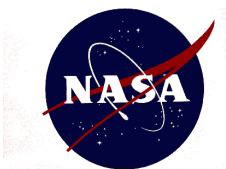
- Designed for low cost radiosonde application
- Optical detection of mist or ice on mirror
- Direct measurement of dew point temperature—RH calibration unnecessary
- No influence from radiation, wind, or other such factors
- Doubtful accuracy when in clouds, but detects cloud tops and bottoms
- Measurement range ~4 percent to 100 percent RH
- Response and long-term stability still being studied
- Reusable, when found
- LT accuracy believed to be  $< \sim 2\text{-}5$  percent
- UT accuracy believed to be  $< \sim 15$  percent



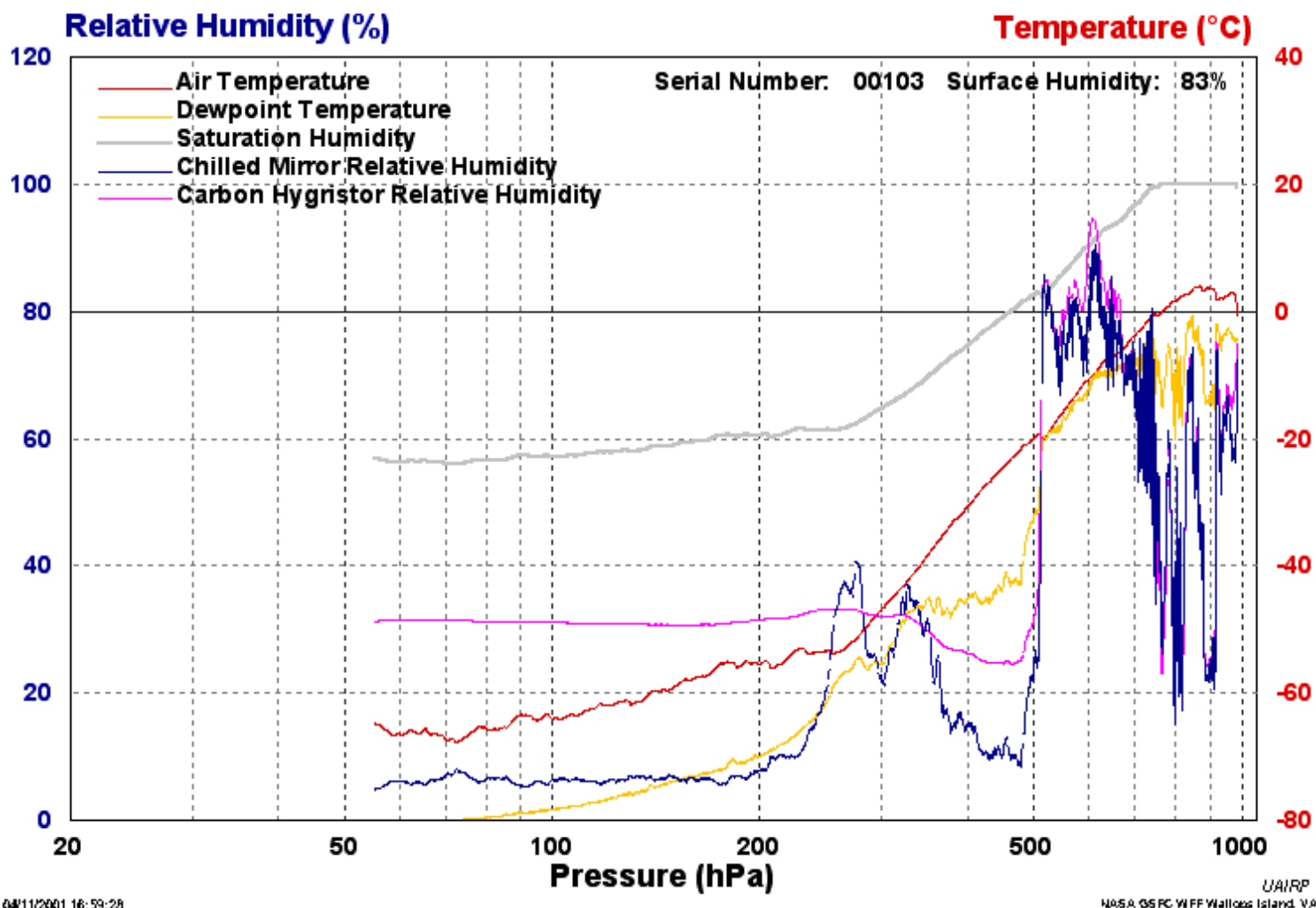


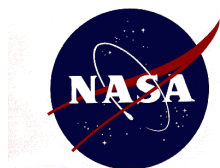
# CHILLED MIRROR



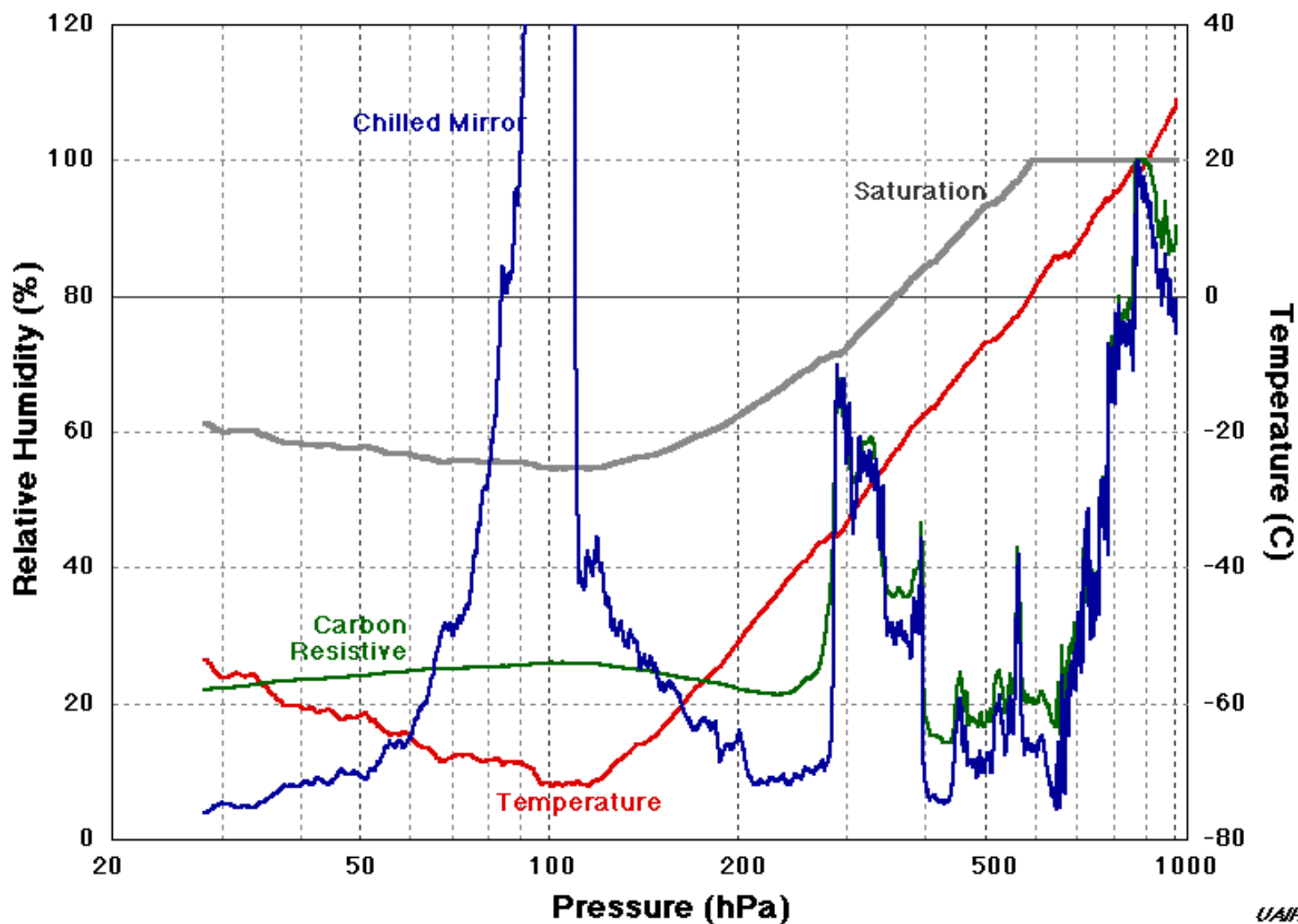


**AFWEX -- Chilled Mirror -- DOE ARM Site, Lamont, OK**  
**ARM2014 12/09/2000 03:24:46 UTC**

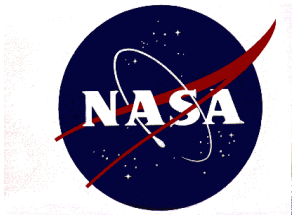




Andros Island, the Bahamas (24.7°N, 77.8°W) 09/14/98 01:22:07 UTC

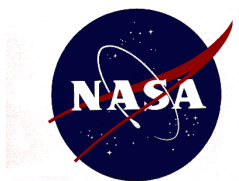


UAIRP  
NASA Wallops Island, VA

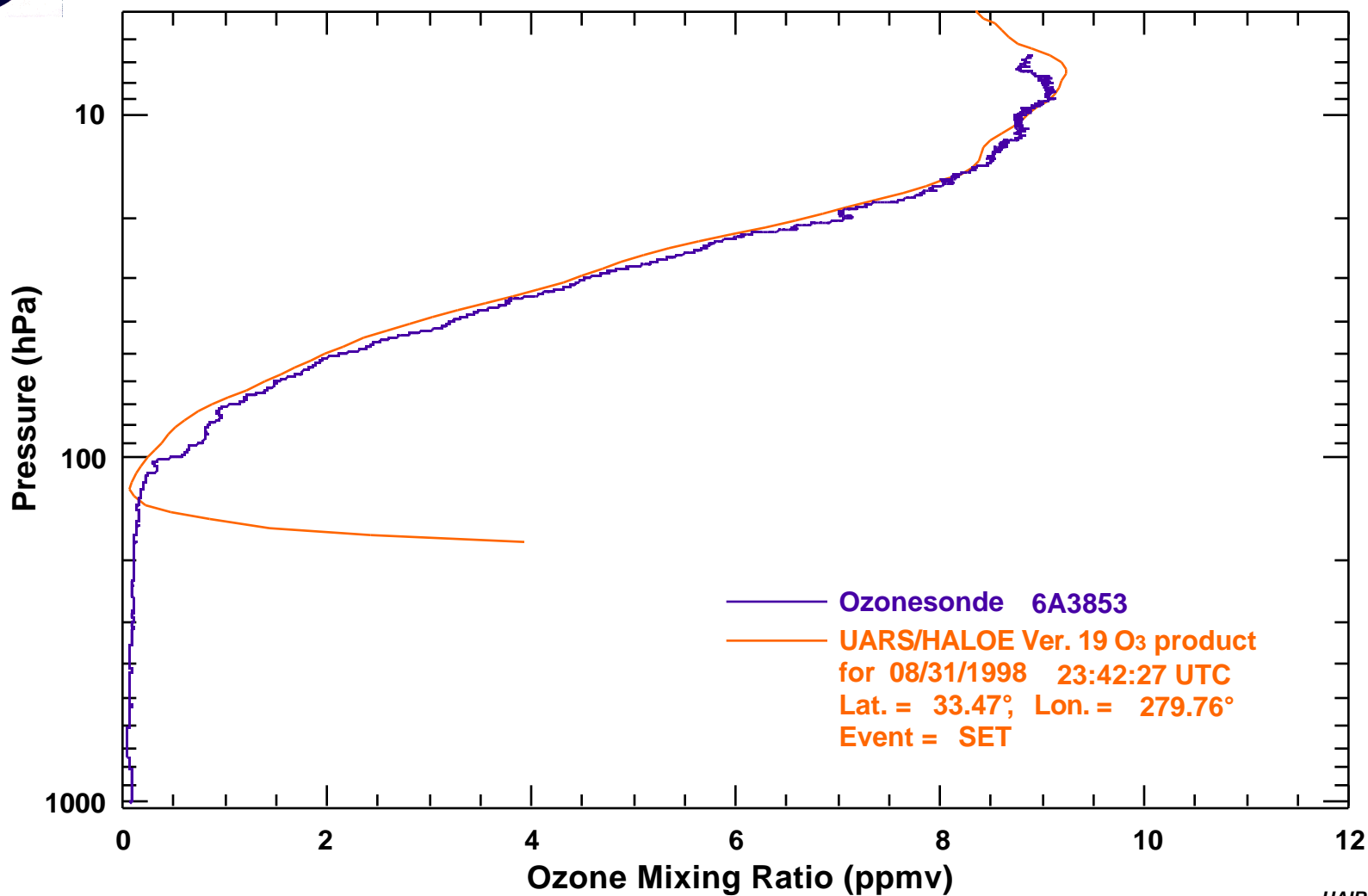


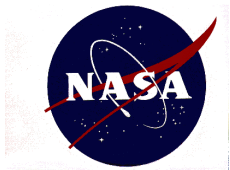
# ECC OZONESONDE

- OZONESONDES PROVIDE *IN SITU* VERTICAL OZONE PROFILES
- ECC ACCURACY IS SENSITIVE TO TERMS CONTAINED IN THE OZONE EQUATION but GENERALLY WITHIN  $\pm 10$  PERCENT
- THE PREPARATION PROCEDURES USED AT WALLOPS ISLAND ARE ALSO USED AT NATAL, ASCENSION ISLAND, and IN FIELD CAMPAIGNS
- ECC TOTAL COLUMN OZONE OVER-BURDEN COMPARES WITH DOBSON SPECTROPHOTOMETER ON AVERAGE WITHIN  $\sim 5\%$
- ECC COMPARISON WITH LIDAR AND HALOE INDICATES THE ECC TO BE  $\sim 11$  PERCENT LOWER AT  $\sim 10$  hPa



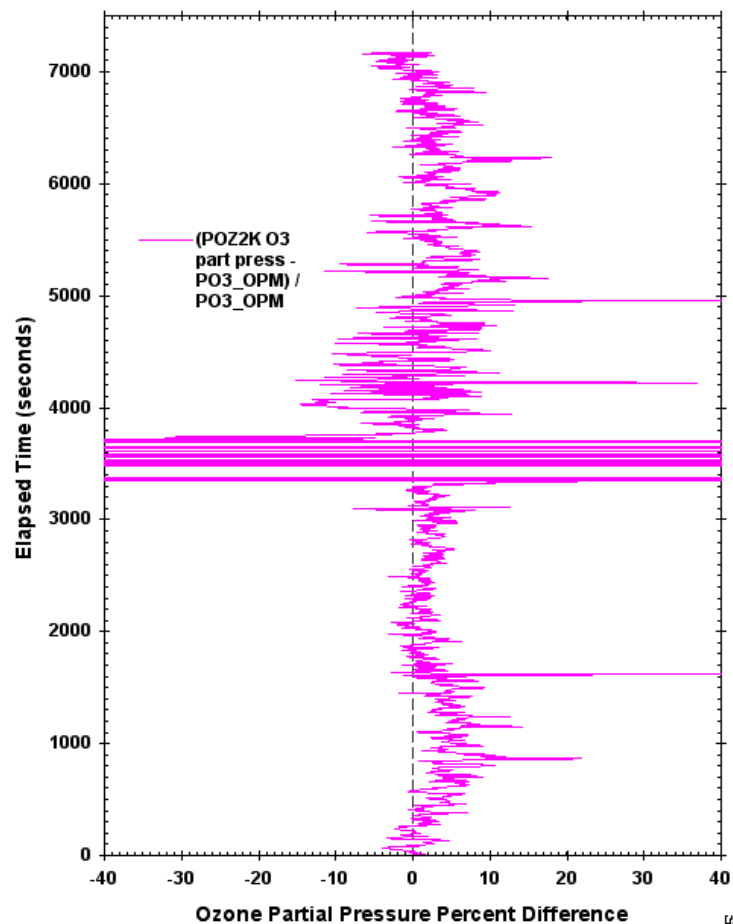
Wallops Island (37.93°N, 75.48°W) nbw1463 08/31/1998 22:05:10 UTC





### JOSIE-2000 FZJ/ICG-2 Juelich, Germany

Simulation Run No. 2 (Mid Latitude Profile) 09/20/2000 12:08:34 6A9775

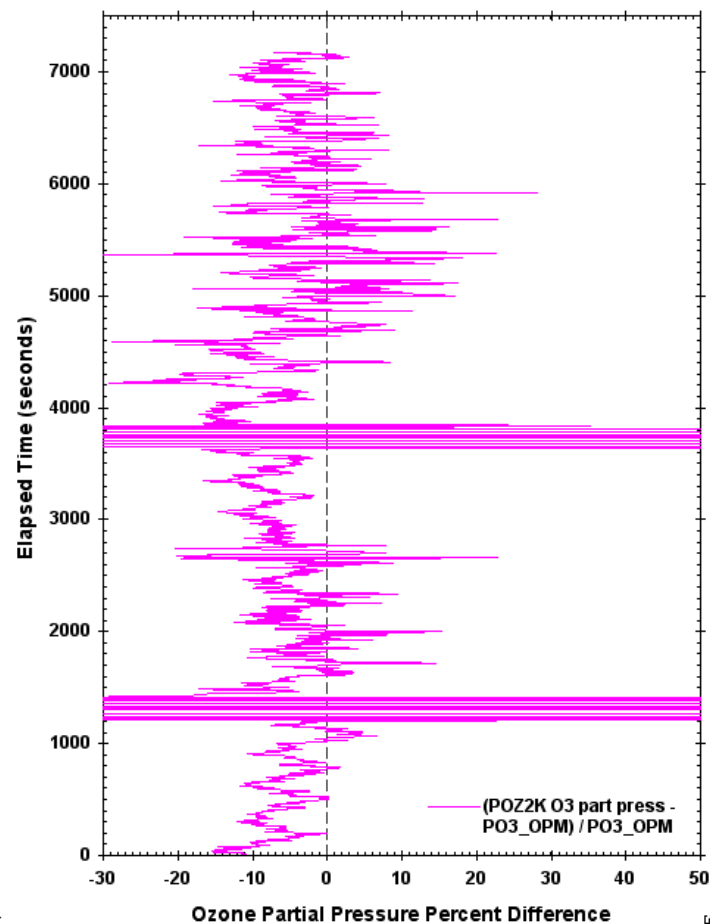


03/08/2001 18:58:12

UABRP  
NASA GSFC WFF 0308/2001 21:17:24

### JOSIE-2000 FZJ/ICG-2 Juelich, Germany

Simulation Run No. 7 (Sub-Tropical Profile) 09/27/2000 10:30:25 6A9779



UABRP  
NASA GSFC WFF 0308/2001 21:17:24



# VALIDATION APPROACH

Validation instruments will be released from a defined location such as NASA/GSFC/Wallops Island

Instrument release will be timed to reach the stratosphere within one-half hour of AIRS ephemeris

Only AIRS ephemeris within  $\pm 2$  degrees latitude will be supported

Daytime (60%) and nighttime (40%) observations are planned

Upper stratosphere/mesosphere measurements (rocketsondes) can be made only if resources(\$) are available

